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PUBLISHED SEPARATELY:

Flood Insurance Rate Map

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FLOOD INSURANCE STUDY
KINGSBRIDGE MUNICIPAL UTILITY DISTRICT, TEXAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Kingsbridge Municipal Utility District, (M.U.D.) Fort Bend and Harris Counties, Texas, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert the Kingsbridge M.U.D. to the regular program of flood insurance by the Federal Emergency Management Agency (FEMA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

This Flood Insurance Study (FIS) was prepared by compiling pertinent information for the flood hazard areas from the Fort Bend County FIS and Channel and Bridge Improvements of Keegans Bayou by Turner Collie & Broden Inc.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.3 (d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgments

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Espey, Huston & Associates, Inc.

1.3 Coordination

On November 17, 1983, the results of this study were reviewed and accepted at a final coordination meeting attended by representatives of the study contractor, FEMA, and the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the area within the Kingsbridge Municipal Utility District, Texas. The area of study is shown on the Vicinity Map (Figure 1).

Keegans Bayou was the only stream studied in detail in the Kingsbridge M.U.D.

The area studied by detailed methods was selected with priority given to all known flood hazard areas, and areas of projected development or proposed construction for the next five years, through April 1985.

2.2 Community Description

The Kingsbridge M.U.D. is located in the northeast portion of Fort Bend County and the southwest portion of Harris County. It is northwest of the City of Sugar Land. Fort Bend County is located in the southeastern portion of the State of Texas. The topography of Fort Bend County is relatively flat, except for the changes in elevations along the channels of the streams. This type of topography is indicative of the Texas Coastal Region. The soil in Fort Bend County is predominantly impervious clay.

Temperatures range from 92 degrees F to 73 degrees F in the summer and 65 degrees F to 45 degrees F in the winter.

The rainfall occurs during intense local thunderstorms of short duration, general storms extending over periods of several days, during periods of hurricanes and other tropical disturbance. Normal annual precipitation is 44 inches.

2.3 Principal Flood Problems

Reports on historical flooding show that major storms or floods have occurred during the years of 1899, 1900, 1913, 1915, and 1929. The flood of 1899 and the storm of 1900 did untold damage to Fort Bend County; crops, stock, and lives were all lost during these two events.

2.4 Flood Protection Measures

Channelization of Keegans Bayou was completed in 1984 by Turner Collie and Braden, Inc. This channelization includes the reach of Keegans Bayou within the Kingsbridge Municipal Utility District and provides protection for the 100-year flood.

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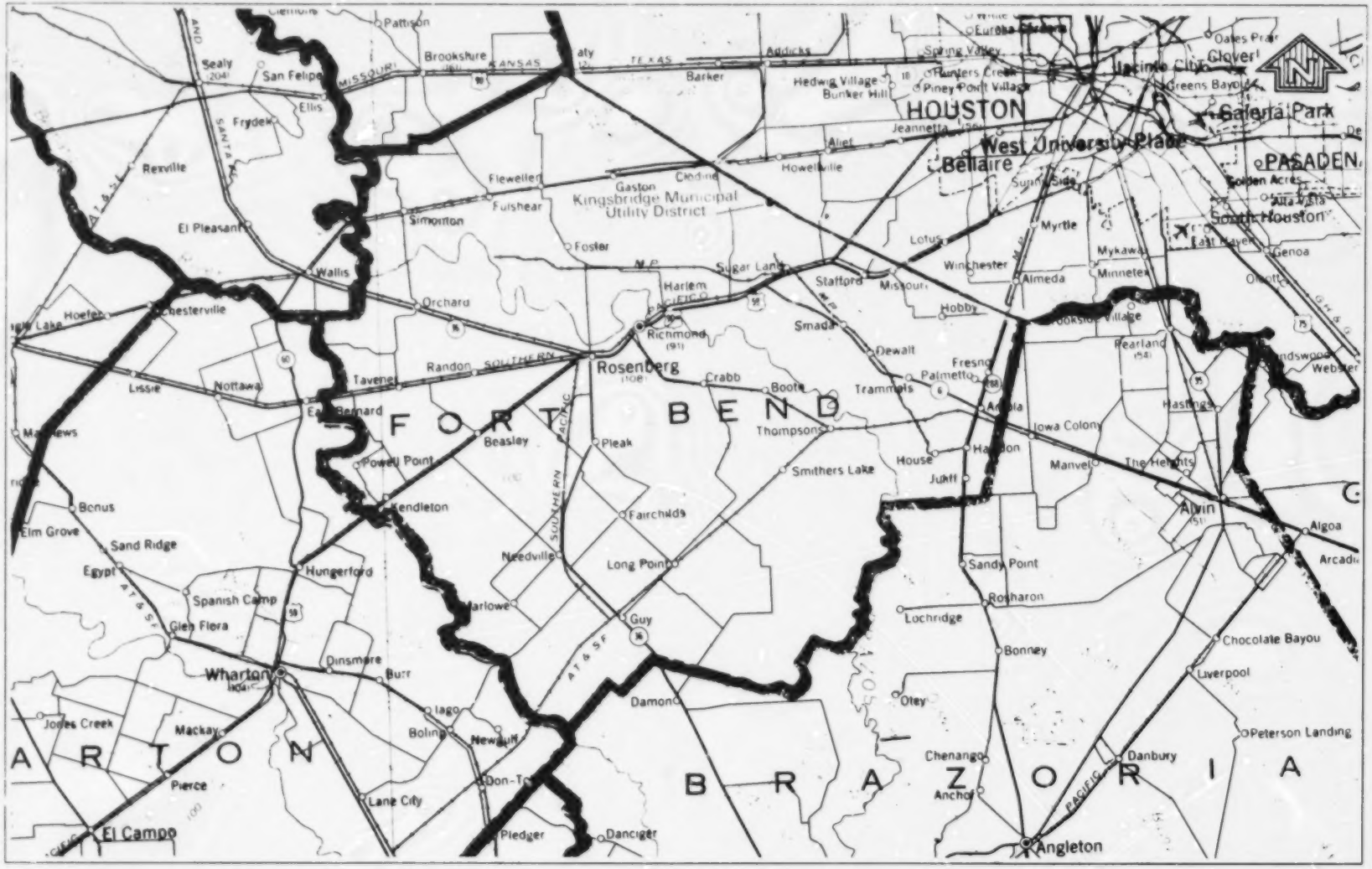

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

KINGSBRIDGE MUNICIPAL UTILITY DISTRICT, TX

(FORT BEND AND HARRIS COS.)

APPROXIMATE SCALE

8 0 8 16 24 MILES

VICINITY MAP

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3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, and 500-year period (recurrence intervals), have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one percent chance of annual occurrence) in any 50 year period is about 40 percent (four in 10), and for any 90 year period, the risk increases to about 60 percent (six in 10). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for floods of the selected recurrence intervals for the flooding source studied in detail affecting the community.

The 100-year discharges used in this report were developed by Turner Collie and Braden, Inc., for the Keegans Bayou channelization project.

The peak discharge-drainage area relationships for the selected recurrence intervals are presented in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
KEEGANS BAYOU					
At State Highway 6	2.9	N/A	N/A	923	N/A

NA - Not Available

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3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in detail in Kingsbridge M.U.D. were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of the flood sources.

Hydraulic analyses for Keegans Bayou developed in the Fort Bend County FIS and Channel and Bridge Improvements of Keegans Bayou by Turner Collie & Braden Inc. were used in this report.

Cross section data for the stream in the study area was obtained by third order leveling and interpretation of USGS quadrangle maps with 5-foot contour intervals. All bridges, dams and culverts were field checked to obtain elevation data and structural geometry. Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Roughness coefficients (Manning's "n") for the computations were estimated on the basis of field observation and literature reference. The roughness coefficients ranged from 0.040 - 0.060 for the main channel and 0.110 - 0.130 for the overbank areas.

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals (Exhibit 1). Water-surface elevations of floods of the selected recurrence intervals were developed using the HEC-2 computer model.

The starting water-surface elevations were obtained by slope-area computation.

The elevations used in this study are referenced to the National Geodetic Vertical Datum (NGVD); the elevation reference marks used in this study are shown and described on the maps.

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations as shown on the profiles are, therefore, considered valid only if hydraulic structures, in general, remain unobstructed and if channel and overbank conditions remain essentially the same as ascertained during this study.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

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4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by FEMA as the base flood for purposes of flood plain management measures. For the stream studied in detail, the boundary of the 100-year flood has been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using USGS Topographic Maps at a scale of 1"=24,000' with a contour interval of 5 feet.

The boundary of the 100-year flood is shown on the Flood Boundary and Floodway Map. Small areas within the flood boundaries may lie above the flood elevations and, therefore, may not be subject to flooding. Owing to limitations of the map scale and/or lack of detailed topographic data, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights. Minimum standards of FEMA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this report are presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

The floodway presented in this study was computed on the basis of equal conveyance from each side of the flood plain. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 2).

As shown on the Flood Boundary and Floodway Map, the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown.

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Keegans Bayou								
A	38,887	*	929	1.5	86.3	86.3	87.3	1.0
B	39,780	*	1,067	1.3	86.4	86.4	87.4	1.0
C	40,780	*	1,007	1.4	86.6	86.6	87.6	1.0
D	41,894	*	953	1.0	86.7	86.7	87.6	0.9
E	42,074	*	818	1.1	86.7	86.7	87.6	0.9
F	42,780	*	859	1.1	86.7	86.7	87.6	0.9
G	44,330	*	752	1.2	86.8	86.8	87.7	0.9
H	45,830	*	731	1.3	87.0	87.0	87.9	0.9
I	46,830	*	709	1.3	87.1	87.1	87.9	0.8

[1] Feet above confluence with Brays Bayou

*Floodway coincident with channel banks

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TABLE 2

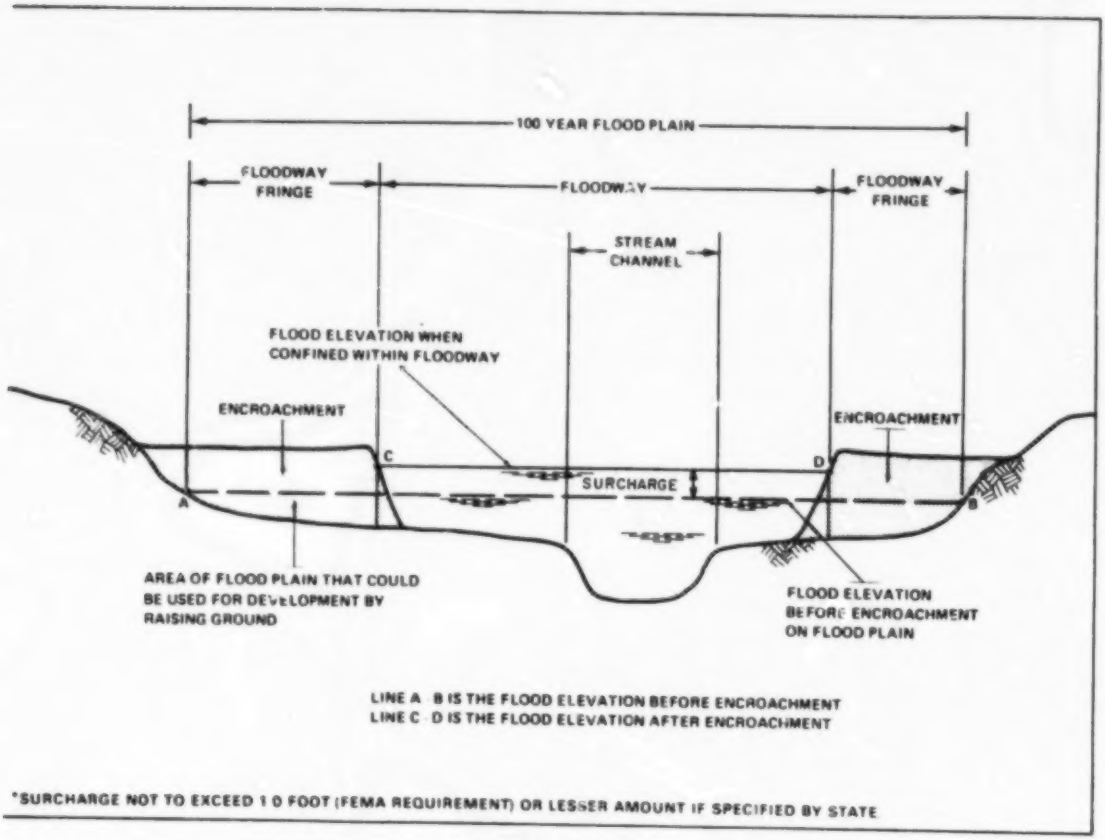
FEDERAL EMERGENCY MANAGEMENT AGENCY

KINGSBRIDGE MUNICIPAL UTILITY DISTRICT, TX

(FORT BEND AND HARRIS COS.)

FLOODWAY DATA

KEEGANS BAYOU


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FLOODWAY SCHEMATIC

Figure 2

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The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, FEMA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHFs), and flood insurance zone designations for each significant flooding source affecting the Kingsbridge M.U.D.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the Kingsbridge M.U.D. shown on the Flood Profiles and are summarized in Table 3, "Flood Insurance Zone Data."

5.2 Flood Hazard Factors (FHFs)

The Flood Hazard Factor is used to correlate flood information with insurance rate tables. Correlations between property damages from floods and their assigned FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between the water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, the accuracy for the FHF is to the nearest foot.

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5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the area within the Kingsbridge M.U.D. was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations.

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to FHFs.
Zone B:	Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; or areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Kingsbridge M.U.D. is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by FEMA.

6.0 OTHER STUDIES

This Flood Insurance Study was compiled from the Flood Insurance Study for Fort Bend County, Texas prepared by Espey, Huston & Associates, Inc., completed in April 1980 and Channel and Bridge Improvements of Keegans Bayou by Turner Collie & Braden Inc.

This report supersedes previous studies published on streams studied in this report and should be considered authoritative for the purposes of the National Flood Insurance Program.

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Keegans Bayou Reach 1	01	*	*	*	005	A	Varies

[1]Flood Insurance Rate Map Panel
[2]Weighted Average
[3]Rounded to the nearest foot - see map

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

KINGSBRIDGE MUNICIPAL UTILITY DISTRICT, TX

(FORT BEND AND HARRIS COS.)

FLOOD INSURANCE ZONE DATA

KEEGANS BAYOU

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7.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, Federal Center, Denton Texas 76201.

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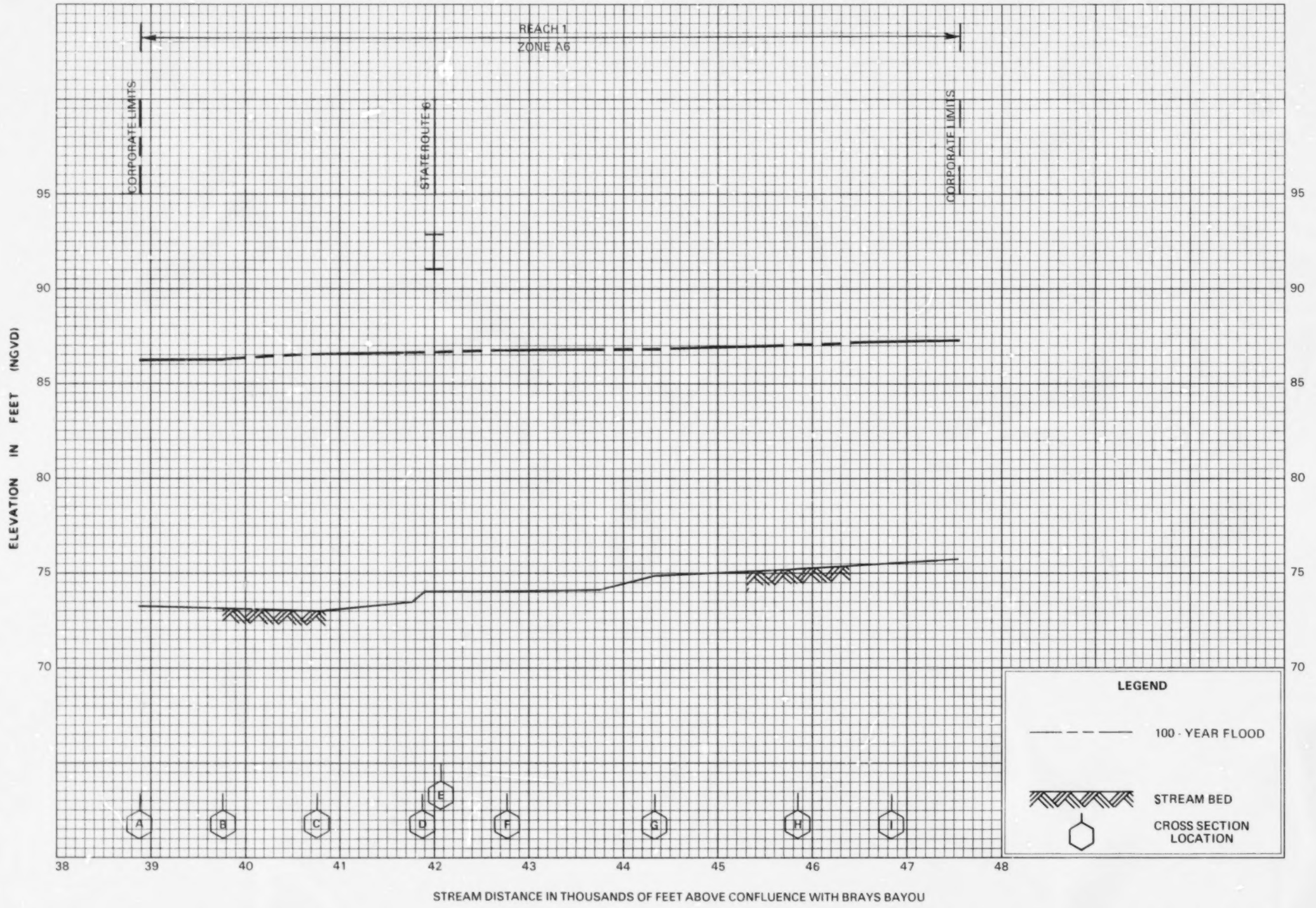

FLOOD PROFILES

KEEGANS BAYOU

FEDERAL EMERGENCY MANAGEMENT AGENCY

KINGSBRIDGE MUNICIPAL UTILITY DISTRICT, TX
(FORT BEND AND HARRIS COS.)

01P

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